FAA-C-2498
November 15, 1971

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

AIR ROUTE SURVEILLANCE RADAR (ARSR-3) ANTENNA TOWER

1. SCOPE

1.1 Scope.- This specification sets forth the technical requirements for the design, fabrication, and integration of standard antenna towers for Air Route Surveillance Radar (ARSR-3) facilities. This specification is to be used with Specification FAA-E-2483, Air Route Surveillance Radar (ARSR-3).

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA standards, drawings, and specifications, of the issues specified in the invitation for bids or request for proposals, form a part of this specification and are applicable in their entirety unless otherwise specified herein. This specification shall take precedence in the event of conflict.

2.1.1 FAA standards

FAA-STD-002	Federal Aviation Agency Standard for Engineering Drawings
FAA-STD-003	Paint Systems for Structures
FAA-STD-005	Preparation of Specification Documents
FAA-STD-013	Quality Control Program Requirements

2.1.2 FAA order

1600.6	Protection of Agency Property
6950.9	Facility Emergency Lighting

2.1.3 FAA drawings

D-5086-20	ARSR-1 and ARSR-1B Towers, Dome Support Plan
D-5547-23	ARSR-2 Tower Antenna Pedestal Platform Framing

2.1.4 FAA specifications

FAA-C-2256	Temperature and Humidity Control Equipment
FAA-C-1217	Electrical Work, Interior
FAA-E-2483	Air Route Surveillance Radar (ARSR-3)
FAA-C-2497	Air Route Surveillance Radar (ARSR-3) Building and Engine Generator System
FAA-C-2499	Air Route Surveillance Radar (ARSR-3) Antenna Radome

(The FAA documents cited above may be obtained from the Contracting Officer in the Federal Aviation Administration office issuing the contract. Requests should fully identify the material desired and should cite the contract involved and use to be made of the requested material.)

2.2 Federal standard

Department of Labor, Title 29, Chapter XVII, Part 1910, Occupational Safety and Health Standards.

(Information on obtaining copies of Federal standards may be obtained from General Services Administration offices in Washington, D. C., Seattle, San Francisco, Denver, Kansas City, Mo., Chicago, Atlanta, New York, Boston, Dallas and Los Angeles.)

2.3 Other publications

2.3.1 Manual of Steel Construction, Seventh Edition.- American Institute of Steel Construction, Inc., 101 Park Avenue, New York, New York 10017.

2.3.2 Specification for Design of Light Gage Cold Formed Steel Structural Members, 1968 Edition.- American Iron and Steel Institute, 150 E. 42nd St., New York, N. Y. 10017.

2.3.3 Uniform Building Code, Volume I, Current Edition.- International Conference of Building Officials, 50 South Robles, Pasadena, Calif. 91101.

2.3.4 National Electrical Code.- Publication No. 70, National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

2.3.5 ASTM Standards.- American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

2.3.6 Lightning Protection Code.- Publication No. 78, National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

2.3.7 IES Lighting Handbook.- Illuminating Engineering Society, 1860 Broadway, New York, New York.

3. REQUIREMENTS

3.1 Items to be furnished by the contractor

3.1.1 Equipment to be furnished.- The contractor shall furnish an antenna support tower, complete, in accordance with all specification requirements. The quantities, heights of towers, and options to be furnished will be specified in the contract schedule.

3.1.2 Documentation to be furnished.- Documentation for the ARSR-3 tower shall be prepared and furnished by the contractor, complete, in accordance with all specification requirements and shall include the items tabulated below.

(a) Design/fabrication drawings and specifications--including design criteria, control dimensions, tower configuration, shop details, processes, and such other information and details as is necessary for fabrication of the tower. Packaging of the tower for shipment to erection sites shall be included in the specification.

(b) Erection drawings and specifications--including part locations and orientation, bolt sizes, welds, conduit runs, and all other necessary information so that field erection of the structure can be accomplished correctly and efficiently. A parts list showing the part number and the member size, weight, and length shall be provided as part of the erection drawings.

(c) Construction drawings and specifications--including the tower site preparation; foundations, including design criteria; and grounding and electrical connections, including interface with the equipment building.

(d) Calculations--covering all design calculations including design assumptions and parameters.

3.2 General description.- The contractor shall design and provide an all steel antenna support tower for ARSR-3 facilities. The tower is intended for use with a 65' diameter rigid radome and a transmitter receiver building as shown on the typical sketches of Attachment 1. The sketches are included to illustrate the general scope and relationships of the overall layout and serve as a base for development and evaluation of the contractor's final design. The contractor is encouraged to propose changes and improvements commensurate with final equipment configurations and state-of-the-art technology. The tower will be constructed on sites selected by the FAA at locations throughout the contiguous United States and the construction contracts will be administered by the FAA. The tower should present an architecturally pleasing appearance since some will be located in proximity to residential areas. The tower shall have a 20 year useful life not requiring regalvanizing, realigning, or adjustment. The tower shall be in accordance with all applicable requirements of Department of Labor Standard, Title 29, Chapter XVII, Part 1910.

3.3 Interface.- The tower being furnished under this specification is intended for use with a radome being designed under FAA-C-2499 and a building being designed under FAA-C-2497. The tower will support a radar antenna system specified in FAA-E-2483. The contractor shall assure compatibility of the interface between components under his own design control and shall coordinate, through the Contracting Officer, to assure compatibility with components furnished by others.

3.4 Service conditions.- With the radome and antenna in place, the towers shall sustain the maximum stresses imposed by the following ambient conditions without permanent deformation, damage, or degradation of operation.

Temperature	-50°C to +60°C
Relative Humidity	5% to 100% including condensation due to temperature changes
Wind Velocity	100 mph (not including gusts) 80 mph (not including gusts) with 1/2" radial thickness of clear ice
Live Load (including snow)	40 psf on entire antenna deck area
Seismic	Zone 3 of Uniform Building Code
Environment	Hail stones - 1/2" diameter Salt spray Urban industrial fumes Fungus - as encountered in warm, humid atmosphere. Wind borne sand and dust as encountered in deserts and plains of Western U. S. Rain

3.5 Architectural

3.5.1 Supporting structure.- The steel tower structure shall be provided for foundation to antenna deck heights ranging from 25' to 75' in 12 1/2' increments. The legs of the structure shall be vertical and spaced to accomodate the building which will be partially installed under the tower. The building will be installed after the tower is completely erected. A mounting ring shall be provided at the top of the structure to accomodate the 65' diameter rigid radome. The design shall provide for future tower heightening in 12 1/2' increments, to a maximum of 75', by addition of tower sections.

3.5.2 Stairway.- A steel stairway shall be provided from the ground adjacent to a building door, to the top deck of the tower. See Sketches No. 1 and No. 2, Attachment 1, for a possible relationship of the tower, stairway, and building. A steel landing shall be provided in the stairway at each 12 1/2' increment. The stairway and landings shall be enclosed by light gage steel panels to exclude wind, rain, and blowing snow and dust. An insect screened window shall be provided at each stair landing for natural light and visual observation of the tower structure. The windows shall be openable for passage of maintenance personnel. The enclosed stairway shall include a vertical areaway adjacent to the stairs which will contain the radar waveguide, coaxial cable, and electrical conduit runs from the building to the pedestal maintenance room. The areaway shall be enclosed from the stairs only as necessary for the physical protection of cable and waveguide. The stairway shall have an entrance into the pedestal maintenance room, an exit to the outdoors at ground level, an exit to the roof level of the ARSR-3 building, and an entrance into the building. Hollow metal doors shall be provided at all exits from the stairway. All doors to the outdoors shall be provided with a lock set in accordance with paragraph 31 of Order 1600.6. The lock set shall be compatible with the existing FAA lock system manufactured by best Universal Lock Company.

3.5.3 Pedestal maintenance room.- This room shall be below and around the antenna pedestal as the location for all maintenance work on the antenna pedestal. The room shall have minimum dimensions of 10' x 16' with a minimum 8' ceiling height. The floor shall be solid steel plate, not grating. The room shall be enclosed by light gage steel panels to exclude wind, rain, and blowing snow and dust. An insect screened window shall be provided in each wall for natural light and visual observation of the tower structure. The windows shall be openable for passage of maintenance personnel. A steel door with guardrail shall be provided in a wall of the room and a monorail with electric hoist shall extend through the door to lower pedestal components and maintenance tools to the ground in the general area under the antenna deck trap door. The monorail shall not interfere with items being lowered through the antenna deck trap door. Hoist capacity shall be determined by the electronic equipment contractor and approved by the contracting officer.

3.5.4 Antenna deck.- The deck shall be at the top of the tower and designed in conjunction with support for the radome mounting ring and antenna pedestal platform. The deck covered by the radome shall be of solid steel plate, not grating. A steel grating walkway with perimeter steel guardrail shall be provided around the radome similar to that shown on Drawing D-5086-20. An 8' x 12' sectionalized trap door shall be provided in the deck, under the radome, for lowering of antenna components and installation and maintenance equipment to the ground. A guardrail shall be provided around the trap door when it is open. The deck shall shield the pedestal maintenance room from harmful radiation.

3.5.4.1 Radome mounting ring.- A steel mounting ring shall be provided on the antenna deck to support the rigid radome furnished by FAA-C-2499. The mounting ring shall form a weathertight seal between the top of the antenna deck and the bottom of the radome. The mounting ring shall have 1 1/16" diameter radome mounting bolt holes at 3° intervals on a 24'-10 7/8" $\pm\frac{1}{4}$" radius bolt circle.

3.5.4.2 Antenna pedestal platform.- A steel mounting platform shall be provided on the antenna deck to support the antenna system pedestal furnished by Specification FAA-E-2483. To provide interchangeability with existing antenna systems the pedestal deck opening and anchor bolt locations shall be compatible with existing platform framing shown on Drawing D-5547-23.

3.5.5 Screen wall option.- An expanded metal screen wall shall be provided around the exterior vertical surfaces of the tower, extending from the foundation to the antenna deck. The screen wall shall shield the tower structure from the view of the surrounding community. Items to be furnished by the screen wall option include the screen wall and all metal hardware required to support and attach the screen wall on the tower structure. The option shall be designed for the basic 25' high tower and for 12 1/2' incremental heights to make any tower height up to 75'. The open area of the screen material should not exceed 30% of the total area and the openings shall be oriented to most effectively block the view from the ground. The screen wall, interior and exterior, shall have a protective coating in accordance with FAA-STD-003. Ferrous screen wall support and attachment hardware shall be galvanized in accordance with paragraph 3.6.1. The exterior surface of the screen wall shall be colored to match the color of the ARSR-3 building, in accordance with Specification FAA-C-2497.

3.6 Structural

3.6.1 Design criteria.- Structural steel designs shall be in accordance with publications listed in paragraph 2.3.1 and 2.3.2, as applicable. Design loads shall be based on the service conditions of paragraph 3.4. The antenna deck and maintenance room floor systems shall be designed to support a uniform live load, as determined by the contractor, based on the maximum loads of equipment and personnel to be supported during operation and maintenance but not less than 40 psf. All steel shall be

galvanized after fabrication in accordance with ASTM A123, A153, and A525 standards, whichever is applicable. Weight of coating for sheets galvanized in accordance with ASTM A525 shall be 1.50 oz./sq. ft., minimum. Part numbers shall be stamped on all structural steel pieces prior to galvanizing. All structural and foundation designs shall include provisions for addition of the screen wall option, paragraph 3.5.5.

3.6.2 Foundation designs.- The contractor shall design and provide foundation construction drawings and specifications suitable for Government contracts with small general contractors at field installation sites. A single foundation design shall be prepared for all tower heights up to 75'. An allowable soil bearing pressure of 4,000 psf shall be assumed for the design with a 48" maximum frost penetration. A minimum factor of safety shall be provided for any uplift conditions on foundations. The tower reactions on the foundations for the design conditions shall be indicated on the construction drawings.

3.7 Electrical

3.7.1 General.- All electrical work shall be in accordance with FAA-C-1217 and the National Electrical Code.

3.7.2 Stairway.- A minimum illumination level of 20 footcandles shall be provided on the stairs and landings. Stairway lights shall be controlled by switches at the ground level and pedestal maintenance room. Rechargeable battery operated lights shall be provided at each stairway level in accordance with FAA Order 6950.9.

3.7.3 Pedestal maintenance room.- A minimum illumination level of 50 footcandles shall be provided at a work plane 30 inches above the floor. A 120 volt and 208 volt 20 ampere duplex convenience outlet shall both be provided on two opposite sides of the room for operation of power tools and unit heaters.

3.7.4 Antenna deck.- A minimum illumination level of 30 footcandles shall be provided within the radome by lights located around the radome base near floor level. A 120 volt and a 208 volt duplex convenience outlet shall both be provided on two opposite sites of the radome near floor level and near the antenna pedestal.

3.7.5 Lightning protection.- The antenna tower structure shall have a lightning protection system in accordance with the Lightning Protection Code, NFPA Publication No. 78. The tower lightning system shall be integrated with the radome lightning protection system and connected to a #4/0 AWG stranded copper wire counterpoise installed on the outside of the tower footings.

3.7.6 Grounding.- Separate and distinct grounding systems shall be provided for electronic equipment and the electrical power system. The electronic and power system grounds shall be kept independent of the lightning protection system on the tower, but may be connected to the

3.8 Documentation

3.8.1 Drawings.- All drawings shall be made on clear-print paper No. 1000 H or equal with the FAA title block in the lower right hand corner. Provide 1/2" border lines on the top, bottom, and right hand side. Provide a 1½" border on the left side. The drawings shall be made on "D" size sheets (22" x 34"). Sample title and index sheets will be furnished. Drawings shall be prepared in accordance with FAA Standard, FAA-STD-002. These drawings will be reduced to one-half size by the FAA in the future. For this reason, the contractor shall take effort to assure that all drawings are clear and legible. The details and printing shall be of the size required for microfilming on 35mm film. The minimum letter height for a 22" x 34" sheet will be 5/32" and .05" spacing between letters. All letters shall be vertical capital letters. Notation, symbology, and details used on the fabrication and erection drawings shall be current for the industry and trades involved. Fabrication and erection drawings shall be coordinated so cross reference from the erection drawings to part details can be easily accomplished.

3.8.2 Specifications.- Specifications for the designs shall be prepared in accordance with FAA-STD-005. The drawings and specifications developed shall be complete to the degree that they can be subsequently used by the Government, without modification, as technical documents for inclusion in a Government contract for fabrication, erection, and construction.

3.9 Design submission and approval.- The contractor shall furnish the Contracting Officer three copies of all drawings, specifications, and calculations in the following order. Submission times are as shown.

1. Design (3.1.2a) (3.1.2d) - within 180 days after contract award.
2. Fabrication (3.1.2a) - within 270 days after contract award.
3. Construction (3.1.2c) - within 365 days after contract award.
4. Erection (3.1.2b) - within 365 days after contract award.

No fabrication work shall be started until submissions 1, 2, and 3 have been approved by the Contracting Officer. Approval or required changes for the initial submission will be transmitted to the contractor by the Contracting Officer within forty-five (45) days after receipt by the Government. Subsequent resubmissions will be returned within twenty-one (21) days. Design approvals shall in no way relieve the contractor from meeting the requirements of this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality control provisions.- The contractor shall provide and maintain a quality control program in accordance with FAA-STD-013. All tests and inspection shall be subject to Government inspection.

4.2 Documentation.- The contractor or his authorized representative shall sign the original tracings of all drawings and the first page or all specifications and design calculations under the contractor's printed name and over the affixed replica of his professional seal or his registration certification number including the state or jurisdiction of issue.

4.3 Tower

4.3.1 Assembly test.- The first tower produced shall be erected to a $37\frac{1}{2}$' height by the contractor using components fabricated in accordance with the fabricator's standard production practices. The purpose of this test is to demonstrate to the Government that the design and fabrication contractors are meeting the requirements of the specification. The test will assist the contractors in checking of detail dimensions and the fit of parts. The erection shall be made at a location approved by the Contracting Officer and all site preparation work and foundations shall be provided by the contractor. Revised copies of all documentation shall be furnished to the Government, as necessary, after completion of the assembly test.

4.3.2 Visual and mechanical inspection.- The towers shall be inspected for conformance to the fabrication drawings and specifications and the requirements of this specification. The inspection shall include but not be limited to, workmanship, dimensions (including straightness, squareness, and flatness), connections, missing parts, damaged materials and finishes, inoperative parts and parts not easily operable. The Government reserves the right to observe and approve the galvanizing process at the subcontractors plant. Fabrication and quality control shall be in accordance with the AISC "Manual of Steel Construction", Seventh Edition.

4.3.3 Electrical work.- All electrical wiring and equipment shall be inspected and tested in accordance with the FAA-C-1217 and the National Electrical Code.

5. PREPARATION FOR DELIVERY

5.1 Equipment.- The contractor shall be solely responsible for protecting, preserving, packing, and marking all equipment for delivery to field installation sites. The equipment shall arrive at the sites in full accordance with the requirements of this specification and acceptable for erection by the contractor or others.

5.2 Documentation.- The contractor shall be responsible for packaging, marking, and shipping all documents required by this specification to 800 Independence Avenue, S. W., Washington, D. C. 20591.

6. NOTES

6.1 Typical layouts.- The sketches of Attachment I portray a typical tower configuration but are not requirements of this specification. These sketches are furnished only as a matter of information to the contractor to assist him in visualizing typical layouts. The Government does not represent or guarantee that conformance thereto will insure that the resulting product will meet specification requirements. Any reliance which the contractor places on Attachment I is wholly at his own risk and shall not relieve him of his contractual obligation to comply with all the requirements of this specification.

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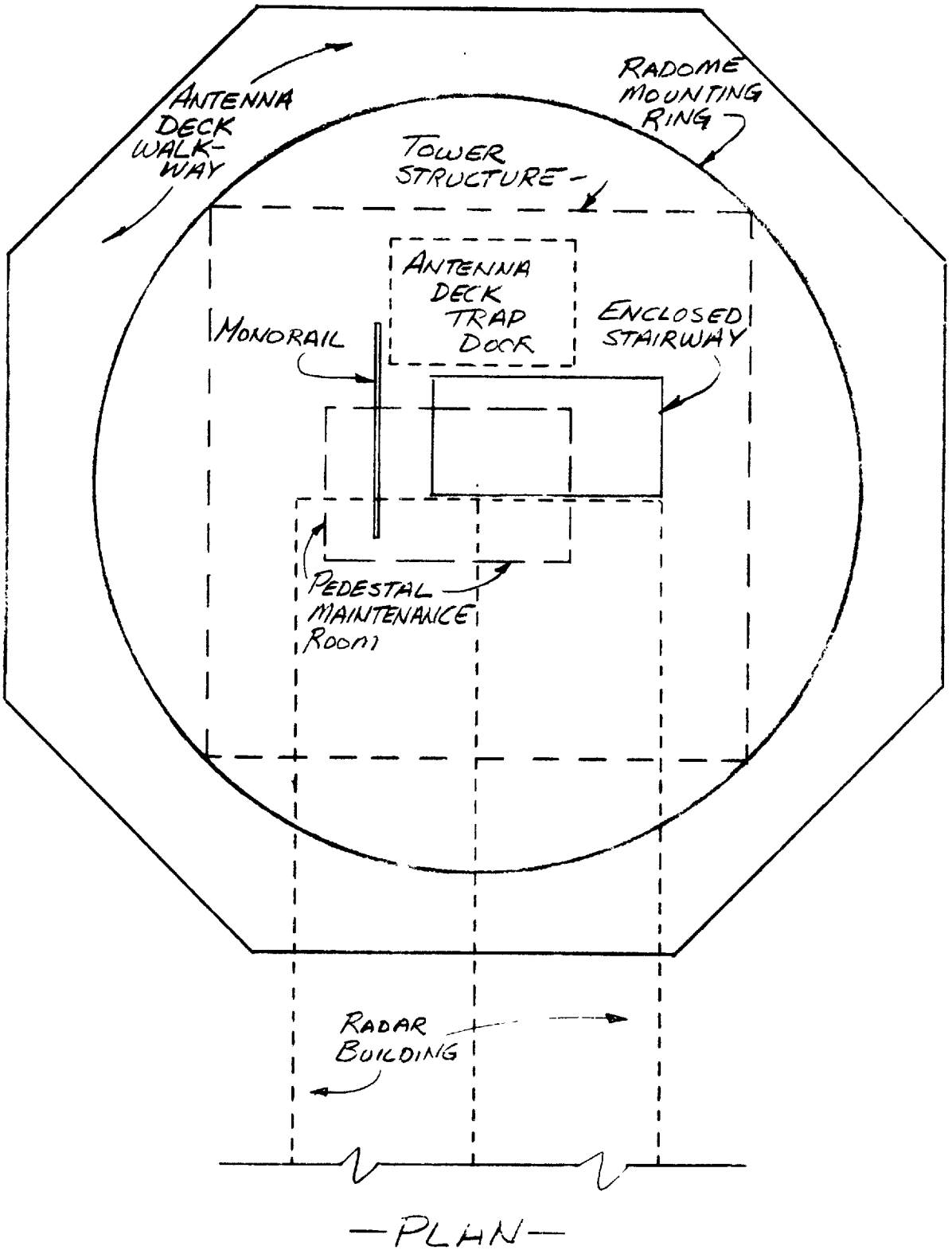
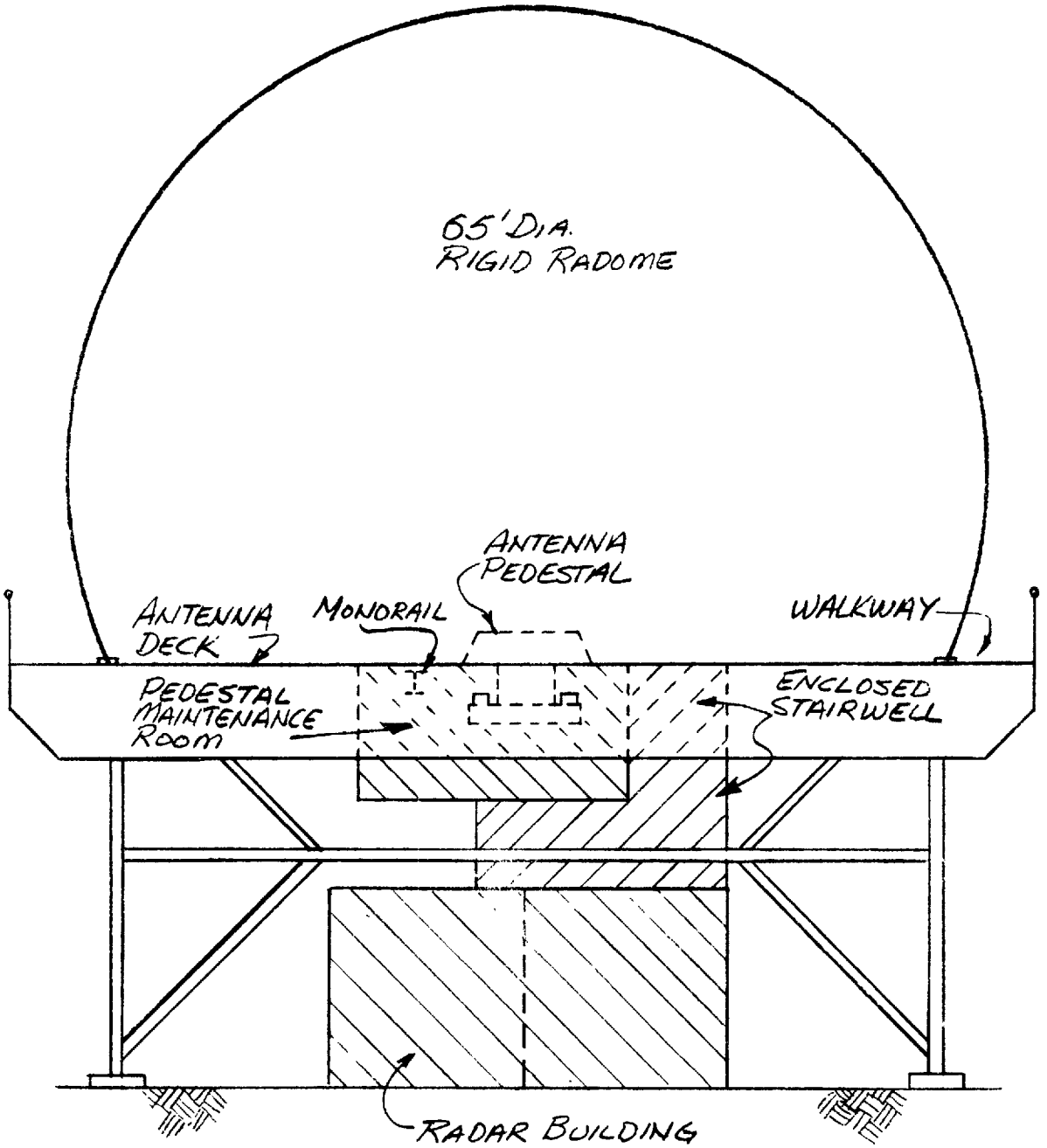
ATTACHMENT 1



—PLAN—

SKETCH #1

ATTACHMENT 1



— ELEVATION —

SKETCH #2

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